Device and method for laying rigid tubular pipes

The present invention relates to a device and a method for laying rigid tubular pipes on the seabed using a laying vessel.

More specifically, this device is designed for so-called J-lay methods, which make it possible to install the pipe without plastic deformation.

It is known for devices such as this intended for laying underwater pipes to include a tower which can be inclined on a working platform and in which a moon pool is provided for example, and means for holding and translationally driving pipe sections, which sections are assembled sequentially to form the pipe which is then submerged.

The pipe sections, which are preassembled on the vessel or on land, are brought sequentially to the said tower and are held by retaining means which for their part are mounted so that they can move translationally up and down the tower. Lower retaining means are mounted in the lower part of the tower and they are designed to hold a free end of the pipe submerged, while upper retaining means are intended to retain a pipe section to be connected.

These retaining means comprise clamping jaws which grip around the outer wall of the pipe sections so as to prevent them from moving translationally. Reference may be made particularly to document WO 99/35429, which describes such retaining means.

However, these clamping jaws necessarily compress the pipes and run the risk of damaging them. This probability is all the likelier in the case of pipes having an outer covering, for example a thermal insulation layer or even an anticorrosion covering.

A problem which arises and which the present invention aims to solve is thus that of providing a device and a method which make it possible to install underwater pipes without damaging them.

To this end, according to a first subject, the present invention proposes a device for laying rigid tubular pipes from a working platform of a laying vessel, the said pipes, which are designed to convey a fluid within, being laid by successively connecting at the said working platform pipe sections which are oriented in a direction between an inclined direction and a vertical direction. The said device comprises lower retaining means designed to retain a pipe and lower securing means designed to support the said retaining means at the said platform, upper retaining means being designed to retain the said pipe and being able to move translationally with respect to the said lower retaining means. The said retaining means are designed to retain the said pipe from the inside, and the said device additionally comprises upper securing means to which the said lower retaining means can be coupled through a pipe section to be connected, in such a way as to release the said lower securing means and to be able to secure thereto the said upper retaining means after the said section to be connected has been connected and submerged.

Thus, a characteristic of the invention lies in the use of retaining means which are designed to retain the pipe from the inside, thus not running the risk of damaging its outer covering, and which can be coupled to upper securing means through a pipe section to be connected. Consequently, not only is the pipe not damaged but, in addition, the device is able to be installed on existing means without major modifications.

According to a particularly advantageous embodiment of the invention, the said retaining means include a locking sleeve prolonged by a cleat, the said locking sleeve being designed to be activated so as to expand inside the pipeline in order to be locked therein either by friction or by indentation. Consequently, this sleeve is prevented from translational movement in the pipe, which can then be retained by a cleat situated outside the pipe or outside the pipe section.

Advantageously, the said lower retaining means are provided with a centring sleeve mounted between the said locking sleeve and the said cleat,

the said centring sleeve being designed to extend between the said pipe and a pipe section to be connected. Consequently, whereas the locking sleeve retains the pipe, the centring sleeve is for its part designed to be fitted partly into the pipe and to project therefrom so that the pipe section to be connected can be fitted thereon, which pipe section may then be welded to the pipe.

According to a particularly advantageous characteristic of the invention, the said lower retaining means are coupled to the said upper securing means by first means forming a sling. Consequently, it is relatively easy to insert these first sling-forming means into the pipe section since they are relatively thin and flexible and, nevertheless, they are designed to withstand high tensile stresses, particularly in order to retain the pipe, as will be described in the remainder of the description.

Preferably, the said upper retaining means are designed to be traversed freely by the said first sling-forming means, which makes it possible for the pipe and the pipe section to be connected to be held independently of one another before they are connected.

The said upper securing means advantageously comprise first means for translationally driving the said first sling-forming means, so as to be able to submerge the connected pipe section while retaining the said pipe, until the upper retaining means are secured to the said lower securing means.

Particularly advantageously, the said upper retaining means are mounted on second means forming a sling, the said second sling-forming means being driven translationally by second drive means mounted on the said securing means, so as to be able to translationally drive the pipe section to be connected and to fit it onto the pipe in order to couple it thereto.

According to a second subject, the present invention proposes a method of laying tubular pipes by using the laying device as described above.

According to a particular embodiment, the said method comprises the steps

below in the following order: a) the said lower retaining means, which are fastened to a pipe, are secured to the said lower securing means; then b) the said lower retaining means are coupled to the said upper securing means through a pipe section to be connected, in such a way as to release the said lower securing means and to connect the said section and the said pipe; and c) the said upper retaining means are secured to the said lower securing means after the said connected section has been submerged.

Thus, according to the method, the load constituted by the pipe is transferred from the lower securing means to the upper securing means through the pipe section to be connected, which then makes it possible to fit and to connect the section to the pipe while keeping the pipe in a fixed position with respect to the said platform where the connecting means are situated.

Other particular features and advantages of the invention will emerge on reading the description presented below of a specific embodiment of the invention, given by way of illustration but with no limitation being implied, with reference to the appended drawings, in which:

- Figure 1 is a schematic front view of a laying device according to the invention;
- Figure 2 is a schematic detail view in vertical section of the laying device illustrated in Figure 1, in a first step of the method;
- Figure 3 is a schematic detail view of the laying device in a second step of the method;
- Figure 4 is a schematic detail view illustrating the laying device during a third step of the method, the connection step;
- Figure 5 is a schematic detail view illustrating the device during a fourth step of the method, corresponding to submersion;
- Figure 6 is a schematic detail view in a fifth step of the method;
- Figure 7 is a schematic detail view illustrating the laying device in a sixth step of the method; and
- Figure 8 is a schematic detail view illustrating the laying device in a final step before returning to the first step.

Figure 1 is a cross-sectional illustration of a laying vessel 10 on the water surface 11, this vessel being equipped with a tower 12 which rises above a moon pool 14. The tower 12 supports a pipe section 16 to be connected which is positioned at the end of a pipe 18, the latter passing through the moon pool 14.

A working platform 19 extends around the periphery of the moon pool 14 and lower securing means 20 are situated on this working platform 19 and rise above the moon pool 14. Furthermore, upper securing means 22 situated at the upper end of the tower 12 make it possible, in particular and in this figure especially, to hold the pipe section 16 to be connected.

Having described the primary structural elements of the device according to the invention, a description will be given below, with reference to Figures 2 to 8, of the successive steps of employing the said device.

Figure 2 again shows the laying vessel 10 in cross section, and the working platform 19. Also shown again are the lower securing means 20 and the end of the pipe 18. As shown distinctly in this Figure 2, the end of the pipe 18 is retained by retaining means 24 which comprise an inner locking sleeve 26 prolonged by a rod 28 which for its part extends outside the pipe 18 and is terminated by a cleat 30, which cleat 30 is engaged in the lower securing means 20.

The locking sleeve 26 is designed to slide in the pipe 18 in an inactive position and it is designed to be activated, either by self-locking means or by control means, so that it bears forcefully against an inner wall 32 of the pipe 18, in an active position. Thus, the locking sleeve is in bearing contact and it is locked by friction or by indentation. In this position, the locking sleeve is completely fastened translationally to the pipe 18, with the result that the end of the pipe 18 is completely fastened and bears against the inside of the lower securing means 20, and is therefore fastened to the laying vessel 10.

In Figure 3, which again shows all the above-described elements, the pipe

section 16 has been positioned vertically over the end of the pipe 18 by the sling 38. Furthermore, the cleat 30 has been coupled to a first sling 34 which passes all the way through the section 16 and the said cleat has been detached from the lower securing means. This first sling 34, which is coupled to translational drive means (not shown) fastened to the upper securing means 22 (not shown in this figure) then completely supports the lower retaining means 24 and, consequently, the pipe 18.

Moreover, upper retaining means 36 have been installed at the upper end of the section 16; they essentially include a second, inner locking sleeve 37, similar to the preceding locking sleeve 26, and they are designed to allow free passage of the first sling 34 which passes through them centrally. Furthermore, a second sling 38, coupled to the second locking sleeve 37 and to the upper securing means, makes it possible to drive the section 16 translationally by virtue of dedicated drive means (not shown).

In Figure 3, the weight of the pipe 18 is taken up by the first sling 34. It is thus possible to move away the lower securing means. Subsequently, the centring sleeve is inserted at the end of the pipe 18. The section is then lowered and welded to the pipe 18. Non-destructive tests may then be carried out and the desired covering is applied at the junction between the pipe 18 and the section 16.

The dedicated drive means makes it possible in particular to fit the section 16 onto the end of the pipe 18, as illustrated in Figure 4. In order to facilitate this fitting and, more precisely, the centring of the section 16 and the pipe 18, a centring sleeve 40 has been fitted onto both ends, i.e. the end of the pipe 18 and the end of the section 16, and between the locking sleeve 26 and the cleat 30 around the rod 28.

After the section 16 and the pipe 18 have been welded together, the drive means for the sling 34, which is still retaining the lower retaining means 24, make it possible to lower the section 16, which now forms part of the overall pipe 18. As illustrated in Figure 5, the lower retaining means 24 then sink under the water surface 11, while the upper retaining means 36

are brought closer to the lower securing means 20.

In Figure 6, after the sling 34 has stopped being driven, the upper retaining means 36 are engaged in the lower securing means 20 in such a way as to transfer the load of the pipe 18 from the upper securing means to these lower securing means 20. Thus, the locking sleeve 26 of the lower retaining means 24 is deactivated so that, by driving the sling 34, it can be lifted back up, together with the centring sleeve 40, into the vicinity of the working platform 19, in the end of the pipe 18. Figure 7 illustrates the lower retaining means lifted back up.

Next, activating the locking sleeve 26 once more causes it to be locked in the pipe 18 and it is once more possible to transfer the load of the pipe 18 to the upper securing means by way of the first sling 34.

Thus, as illustrated in Figure 8, the upper retaining means 36 can be released from the lower securing means 20 and from the pipe 18 so that they can be mounted once more on another pipe section to be connected. Moreover, starting from this position, the first sling 34 can be driven in order once more to secure the cleat 30 in the lower securing means 20 so as to return to the situation illustrated in Figure 2.

Thus, by recommencing this cycle a given number of times relative to the desired length, the pipe is submerged and deposited in the seabed.